Technical Memorandum

Date: October 16, 2007

To: Victor Pacheco, Delta Conveyance Branch Chief
Ajay Goyal, Supervising Engineer

From: Bijaya Shrestha, Senior Engineer
Department of Water Resources

Subject: Hydrodynamic and Water Quality Modeling for Franks Tract Project Alternatives

Introduction

The Delta Conveyance Branch, California Department of Water Resources (DWR) completed the Flooded Islands pre-Feasibility Study Report in June 2005 (DWR, 2005) with the main objectives of improving ecosystem restoration, improving water quality, and enhancing recreation and other social benefits associated with modifications and improvements in Lower Sherman Lake, Big Break, and Franks Tract in the western Delta. The pre-Feasibility Study identified Franks Tract as the most effective location to achieve the stated objectives of the Flooded Islands Project. As a result of high estimated costs, the study recommended construction of a pilot project to verify the benefits. The four pilot project alternatives identified in the study included:

1. West False River Barrier Alternative: It involved construction of a barrier in West False River, and a pocket beach/tidal marsh in the Franks Tract flooded island.
2. North Levee and Two Barriers Alternative: It involved construction of setback levees along False River, barriers on Piper Slough and False River bend, and a pocket beach/tidal marsh in the Franks Tract flooded island.
3. East Levee and Two Barriers Alternative: It involved construction of setback levees along Old River, barriers on False River and Sand Mound Slough, and a pocket beach/tidal marsh in the Franks Tract flooded island.
4. Cox Alternative: It involved construction of barriers on Holland Cut and Old River, and a pocket beach/tidal marsh in the Franks Tract flooded island.

The cost benefit ratio of North Levee and Two Barriers alternative was less than 0.5, while that of the other three alternatives was greater than 2. Therefore the North Levee and Two Barriers Alternative was not carried further. The pre-Feasibility study recommended additional refinement and optimization of the alternatives for the selection of a single preferred alternative. During this effort, a new alternative in the region was identified involving installation of an operable barrier in Three Mile Slough.

DWR (2007) conducted a value engineering study to evaluate the four alternatives shown in Figure 1. The study ranked the Three Mile Slough alternative and the West False River alternative as the best. This memorandum presents the hydrodynamic and salinity modeling results presented to the value engineering team for use in their evaluations.

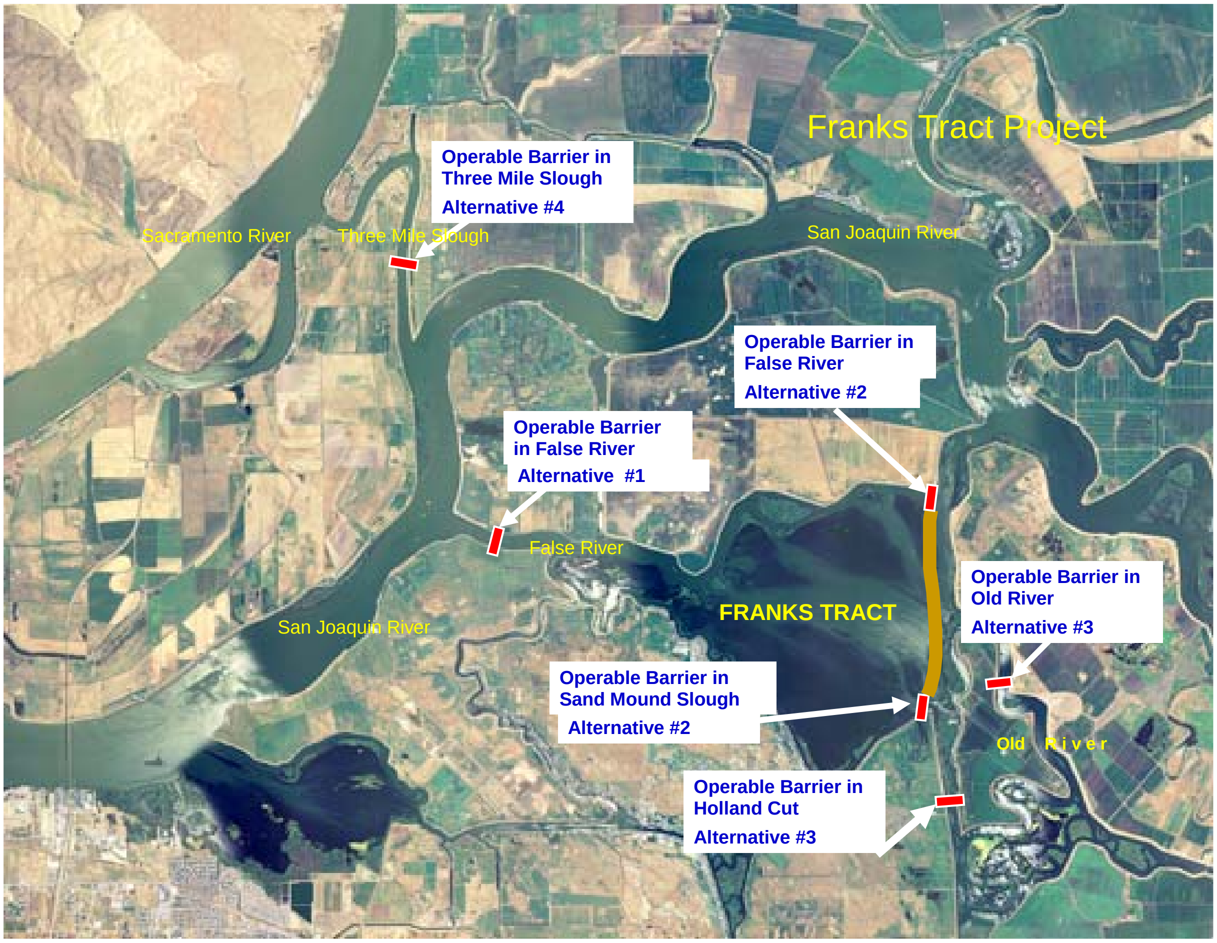

Figure 1. Franks Tract Project Alternatives

Methodology

<u>Selection of Model and Hydrology</u>

The Resource Management Associates' RMA delta model (RMA, 2005) was used to simulate the hydrodynamic and water quality in the Sacramento San-Joaquin Delta associated with the alternatives and their barrier operations. RMA is a multidimensional hydrodynamic-water quality model. The water quality results and analysis presented in this memorandum are limited to salinity, measured in EC.

The first series of simulations were performed for April 10, 2002 through January 1, 2003 for screening of various gate operations for all the four alternatives. This period corresponds with the most recent calibration period for the RMA Delta model and the extensive field monitoring program by the United States Geological Survey (USGS) in the vicinity of Franks Tract region. Water year 2002 was a dry year with significant range of inflows, exports and tidal conditions. The second series of simulations were performed for the West False River Alternative and the Three Mile Slough Alternative for other dry (2001) and critical years (1992, 1994).

The salinity reductions were compared to the base case. The base case is defined as the current condition (historical hydrology) without project. The alternative cases are based on the current condition with the project. The boundary inflows and exports, stage, EC, gate operations, temporary barriers in South Delta, and Delta Inland Consumptive Use are all historical values.

Modeling Results

<u>Alternative #1: West False River Barrier</u>

This alternative involves installation of an operable barrier on West False River (Figure 1). This alternative would physically block sea water intrusion to the Franks Tract region, thereby creating a longer path for sea water to reach export facilities in the south Delta (via Old River). Three different barrier operating criteria were modeled for this alternative:

a) Fully-closed barrier,
b) 20% of barrier width open, and
c) Barrier tidally operated

Figure 2 shows the comparative salinity reduction at the State Water Project (SWP). The fully-closed barrier operation produced the highest reduction in salinity at the SWP. This would require complete blockage of False River during the months salinity reduction is needed. This could have adverse impacts on boating (recreation), local ecosystems, and fisheries. The salinity reduction was comparatively lower when 20% of the barrier width was left open, or when the barrier was tidally operated. During operation with 20% of the barrier width open, the velocity in the vicinity of open portion of barrier was observed to be in the order of 6 to 8 fps, which could be unsafe for boaters. The tidally operated barrier would require closing the gates for approximately 12 hours per day to provide salinity reduction. This operation would allow keeping the False River channel open for at least 12 hours every day which would minimize impacts to boating, ecosystems and fisheries.

Base condition peak tidal flow in False River is about 50,000 cfs. With False River closed, this flow would be largely diverted to the San Joaquin River north of Bradford Island and Webb Tract. A portion of the flow would reenter the western end of Franks Tract along Fisherman's Cut. Tidal flow in Fisherman's Cut would increase from about 2,000 cubic feet per second (cfs) to approximately 10,000 cfs. Channel velocities would increase from about 0.5 feet per second (fps) to about 2.5 fps. The bulk of the diverted flow would reenter the northeast corner of Franks Tract along the Old River channel connecting Franks Tract to the San Joaquin River. Peak tidal flow in Old River would increase from the 13,000 cfs base condition value to approximately 40,000 cfs. South of Franks Tract, the gate closure would reduce tidal flow in Old River near Bacon Island approximately 20%. Tidal flow in Middle River near Bacon Island would remain largely unchanged, and tidal flow increases for Turner Cut are predicted, although peak velocity would remain under 1 fps.

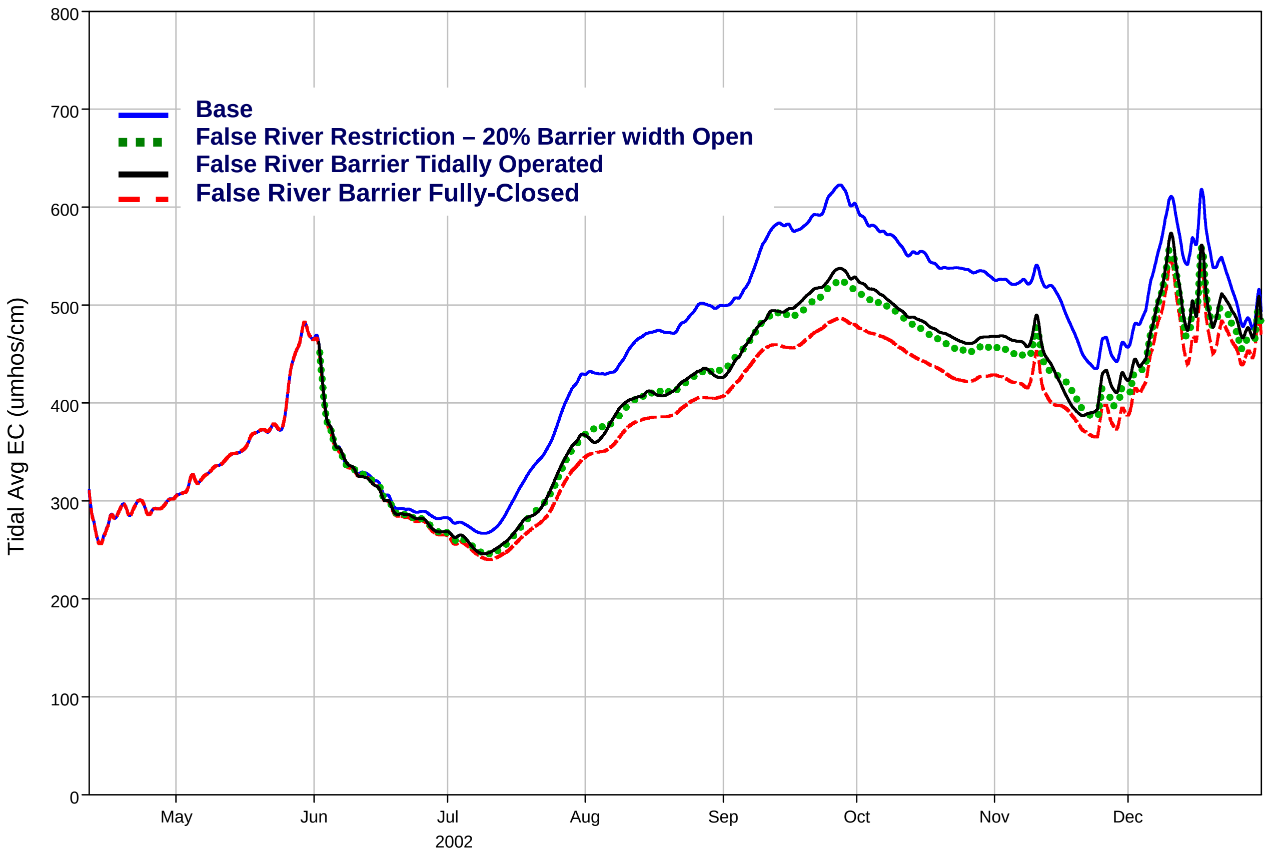

Figure 2. Tidally Average EC at SWP for Different West False River Barrier Operations

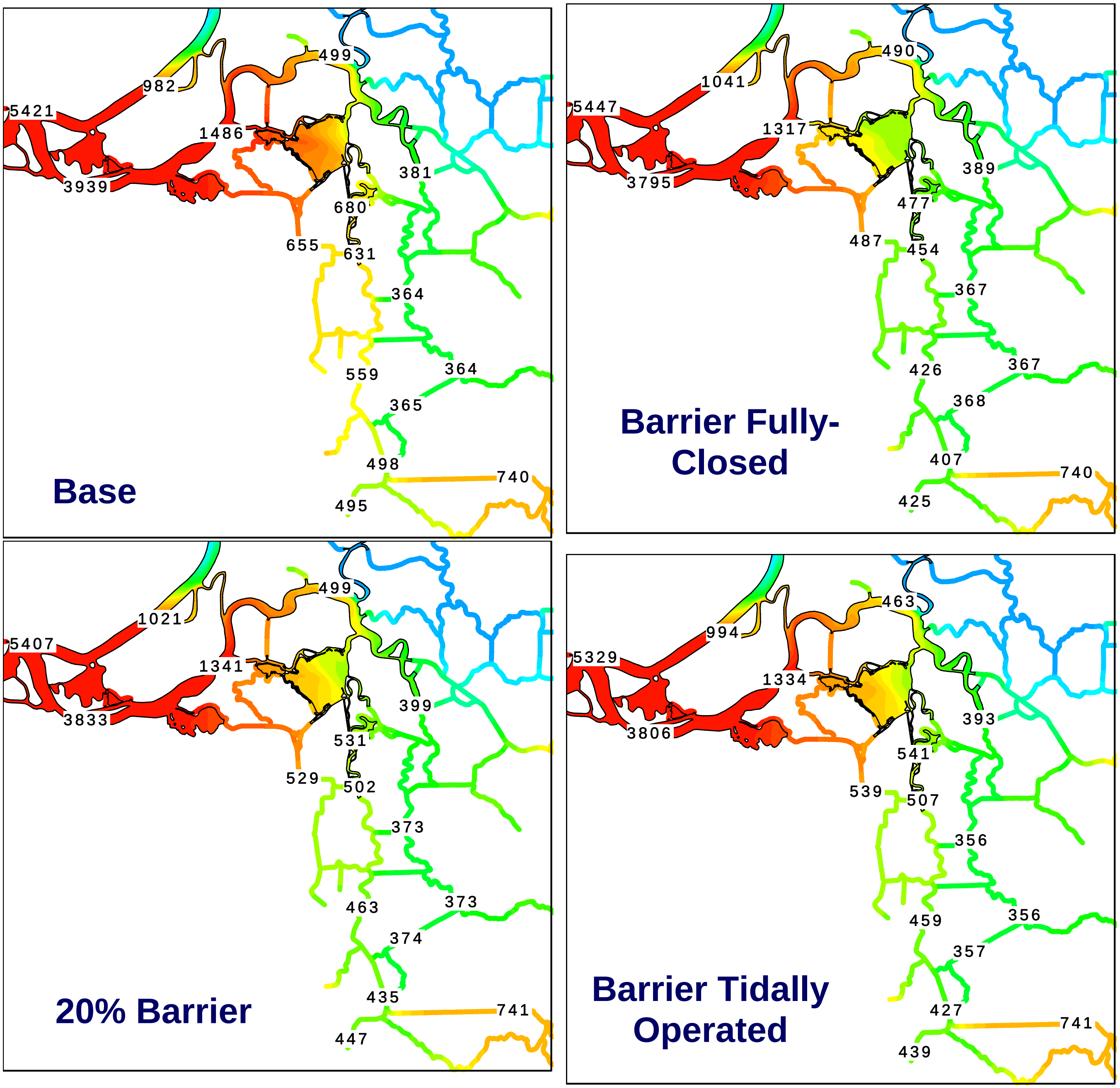

Figure 3. Tidally Average EC Contours on September 1, 2002 for West False River Alternative.

Figure 3 shows a snapshot of EC contours on September 1st of 2002 in the central and south Delta for the base case and the three operational scenarios of the West False River alternative. The figure shows when the barrier is tidally operated, salinity is reduced in Old River, Middle River and Victoria Canal, while the other two operations do not reduce salinity in the Middle River and Victoria Canal. Further, the tidally operated barrier scenario has the least increase in salinity at Emmaton (Sacramento River).

The tidally operated barrier scenario seems to have the least impacts compared to the other two operational scenarios. It was analyzed further for additional years (described later).

Alternative #2: East Levee + 2 Barriers

This alternative includes the reconstruction of approximately 11,700 linear feet of the east levee on Franks Tract and installation of two operable barriers (1) on the east end of False River and (2) in Sand Mound Slough (Figure 1). This alternative would allow the salt water mixing within the Franks Tract, but would provide a physical barrier to reduce salt intrusion into Old River and the south Delta export facilities. This alternative would alter the salt path from Old River to Middle River and Victoria Canal. Two barrier operational scenarios were modeled for this alternative:

a) Both barriers closed, and
b) Barrier on False River tidally operated (Open on Ebb) and barrier in Sand Mound Slough kept closed.

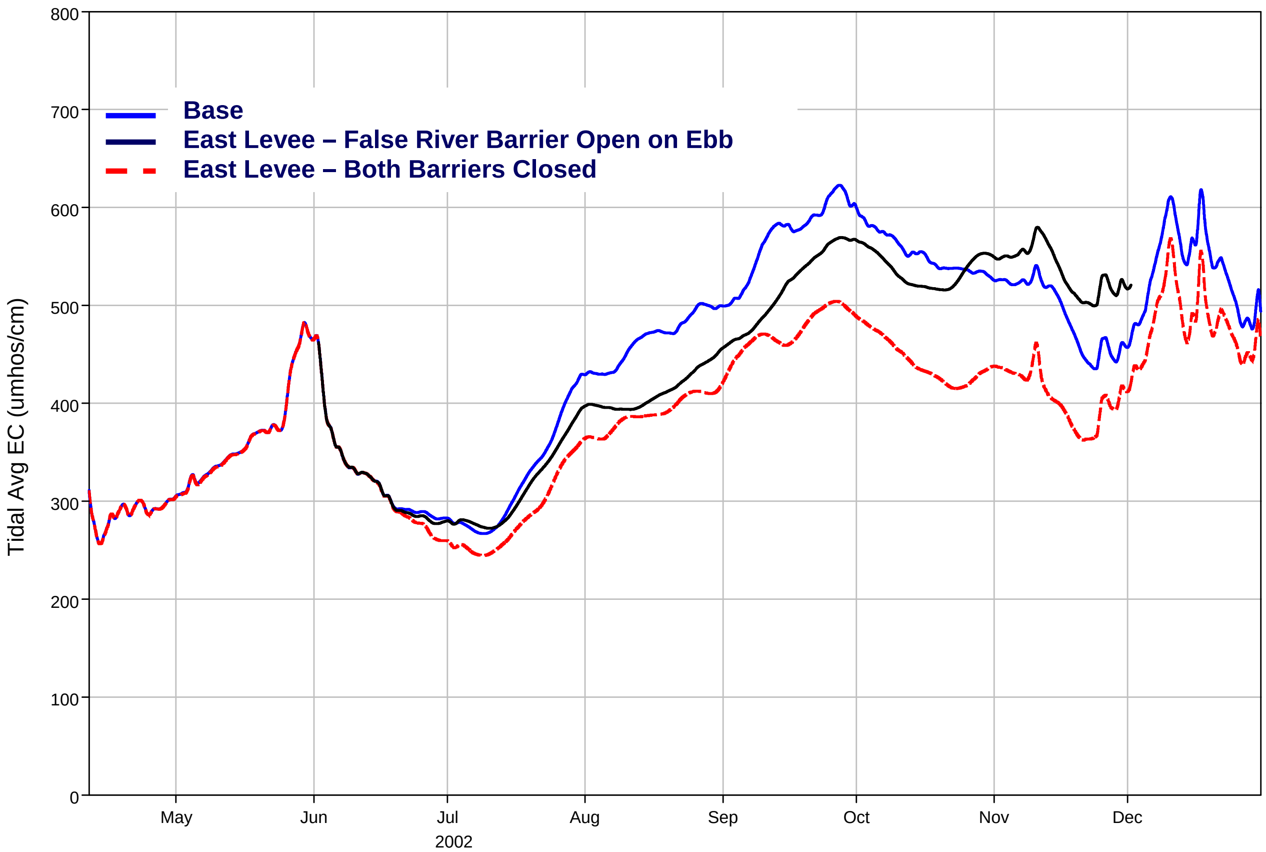

Figure 4. Tidally Average EC at SWP for Different East Levee + 2 Barriers Alternative Operations

Figure 4 shows the comparative salinity reduction at the SWP. The "both barriers closed" operation produced higher reduction in salinity at the SWP than that from the tidal operation of the East False River barrier. The "both barriers closed" scenario, however, would require a complete closure of east end of False River and the Sand Mound Slough. This could have impacts on boating (recreation) and possibly fish resources.

Franks Tract represents a significant tidal prism, so less tidal flow would be diverted from False River to the San Joaquin River in order to fill Franks Tract. Tidal flows on Fisherman's Cut would increase to about 8,500 cfs from 2,000 cfs, with peak tidal velocities about 1.8 fps. With barriers closed, velocities in the eastern half of Franks Tract would be small. Opening the operable barrier on the east end of False River would restore some velocities in the northern portion of Franks Tract. The tidal flow to the southern Delta normally conveyed by Franks Tract would be transferred to the Old River channel connecting the northeast corner of Franks Tract to the San Joaquin River. Peak velocities in this channel would more than double to about 2 fps when the barriers are closed. Tidal flows in Old River and Holland Cut immediately south of Franks Tract would be reduced about 25%. Corresponding tidal flow increases are predicted in Middle River to the east. Further south, flows in Old River and Middle River near Bacon Island would approximate the base condition.

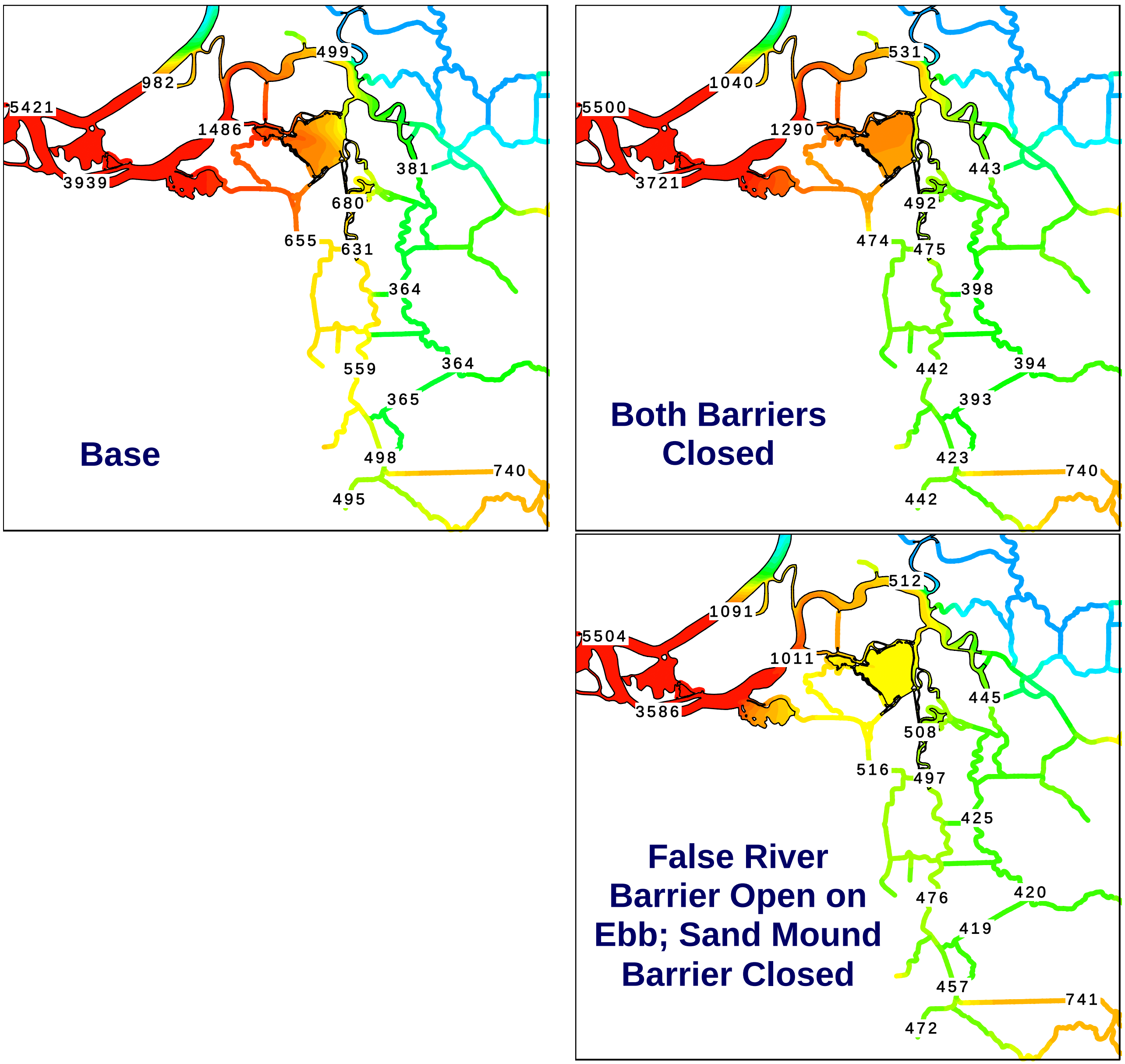

Figure 5. Tidally Average EC Contours on September 1, 2002 for East Levee + 2 Barriers Alternative.

Figure 5 shows a snapshot of EC contours on September 1st of 2002 in the central and south Delta for the base case and the two operational scenarios. For both the operational scenarios, salinity is reduced in Old River, while it is increased in Middle River and Victoria Canal. Further both operational scenarios increase salinity at Emmaton.

Alternative #3: Cox Alternative (Barriers in Holland Cut and Old River)

This alternative involves installation of operable barriers in Holland Cut and in Old River (Figure 1). This alternative would allow the salt water mixing within the Franks Tract, but would provide a physical barrier to reduce salt intrusion into Old River and the south Delta export facilities. This alternative would lengthen the salt path to the export facilities. The salt will reach the export facilities via Middle River and Victoria Canal. Two barrier operational scenarios were modeled for this alternative:

a) Both barriers closed, and
b) Old River barrier tidally operated (Open on Ebb) and the barrier in Holland Cut kept closed.

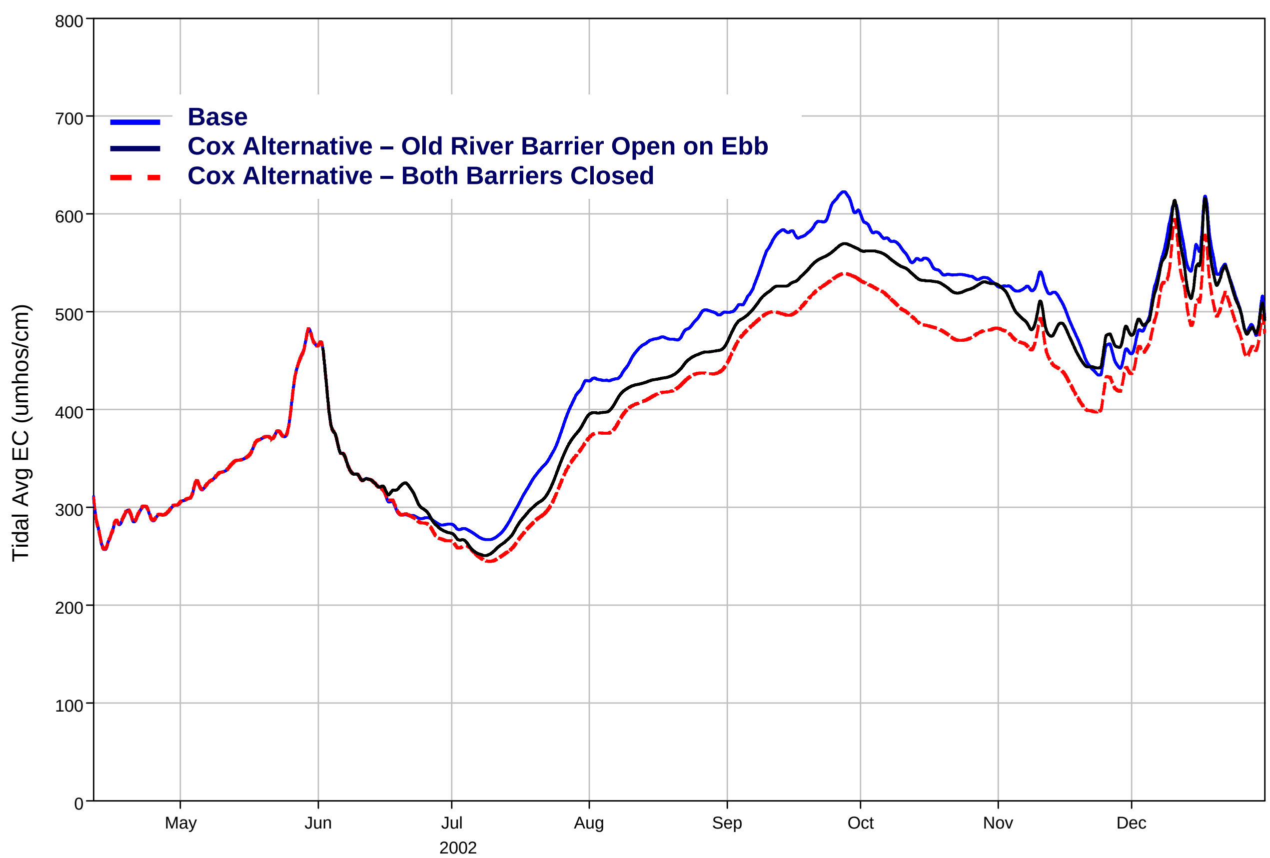

Figure 6. Tidally Average EC at SWP for Different Barrier Operations in Cox Alternative

Figure 6 shows the comparative salinity reduction at the SWP. The “both barriers closed” operation produced higher reduction in salinity at the SWP than that from the tidal operation of the Old River barrier. The “both barriers closed” scenario, however, would require complete blockage of Holland Cut and Old River during the months salinity reduction is needed. There is heavy boating traffic from Old River and Holland Cut to lower San Joaquin River and Franks Tract. The “both barriers closed” operation therefore is not considered a desirable operational scenario.

This alternative largely maintains tidal flow through Franks Tract. However, flow which in the base condition exited out the southeast corner of Franks Tract to the Holland Cut and Old River channels would be redirected out the northeast corner of Franks Tract to the San Joaquin River. Peak tidal flow in this channel would approximately double. Flow formerly conveyed via Old River would be transferred to Middle River. Flow in the Middle River channel north of Mildred Island to the San Joaquin River would nearly double when the barriers are closed. The excess flow from Middle River would travel back to Old River south of the barriers mainly through Connection Slough, north of Bacon Island. Peak flows through the Connection Slough channel would nearly double the peak base condition flows. The two east-west channels, north and south of Woodward Island transfer additional flow from the Middle River to Old River. Flow in Victoria Canal would remain relatively unchanged.   With the Cox Alternative barriers closed, peak flows in Turner Cut would be more double the base condition values. When the export pumps are in operation, average stage for Old River near the Contra Costa Water District (CCWD) intake is lower about 0.15 feet.

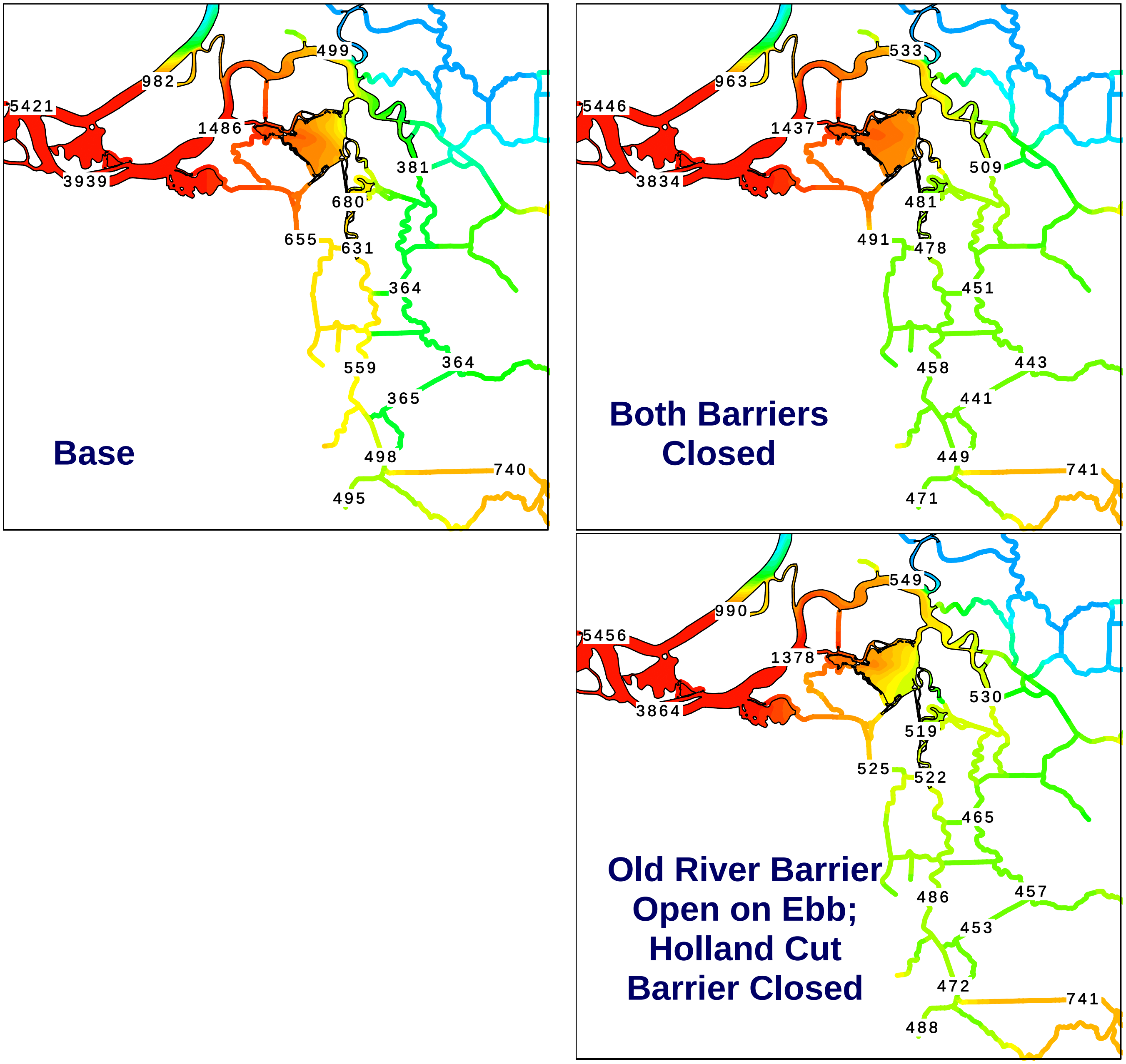

Figure 7. Tidally Average EC Contours on September 1, 2002 for Cox Alternative

Figure 7 shows a snapshot of EC contours on September 1st of 2002 in the central and south Delta for the base case and the two operational scenarios. For both the operational scenarios, salinity is reduced in Old River, while it is increased in Middle River and Victoria Canal. When both barriers on Old River and Holland Cut are kept closed, salinity reduces at Emmaton, while it increases when Old River barrier is opened on Ebb.

Alternative #4: Three Mile Slough

This alternative involves installation of an operable barrier on Three Mile Slough between the Sacramento and San Joaquin Rivers (Figure 1). Under this alternative, the barrier would be closed (usually about 2 to 6 hours) during portions of the ebb tide to force more central Delta freshwater down the lower San Joaquin River channel rather than allowing it to enter the Sacramento River via Three Mile Slough. The Three Mile Slough barrier would be operated on a tidal basis to balance net (tidal) flows in the Sacramento River (at Emmaton) and the San-Joaquin River (near Jersey Point). Net (Tidal) flows are residual flows over one tidal cycle (24.75 hour). The Three Mile Slough barrier operation would increase the net outward flow in the San Joaquin River (near Jersey Point). This increase in net outward flow would help in reducing sea water intrusion in the central and south Delta. The Three Mile Slough barrier would not be operated during the times when 1) there is no sea water intrusion in the central and south Delta; 2) the net outward flows at Emmaton and Jersey Point are balanced; and 3) the combined net outward flows at Emmaton and Jersey Point are small.

Table 1 shows net flows in the Sacramento River at Emmaton and the San Joaquin River at Jersey Point with and without the operation of the Three Mile Slough barrier for June through December of 2002, which was studied. The operation of the Three Mile Slough barrier was developed on the three criteria discussed earlier.

Table 1. Three Mile Slough Operation and Balanced Net Flows at Emmaton and Jersey Point for Year 2002

Time	Net Flows without Three Mile Slough Operation (cfs)		**Additional Net Flows Increase in Three Mile Slough (cfs)**	Net Flows with Three Mile Slough Operation (cfs)	
	Emmaton	Jersey Point		Emmaton	Jersey Point
June	4,950	1,950	**1,500**	3,250	3,560
July	6,400	-830	**3,000**	3,420	2,090
August	5,630	-910	**3,000**	2,650	2,010
Sep (1-20)	5,010	1,250	**2,500**	2,540	3,670
Sep 21 – Oct 15	3,010	1,180	**500**	2,320	1,860
Oct 16 – Nov 10	3,690	2,370	**1000**	2,460	3,570
Nov 11 – Dec 15	4,850	2,170	**2,000**	2,860	4,140
Dec (16-31)	33,830	7,300	**0**	33,030	7,300

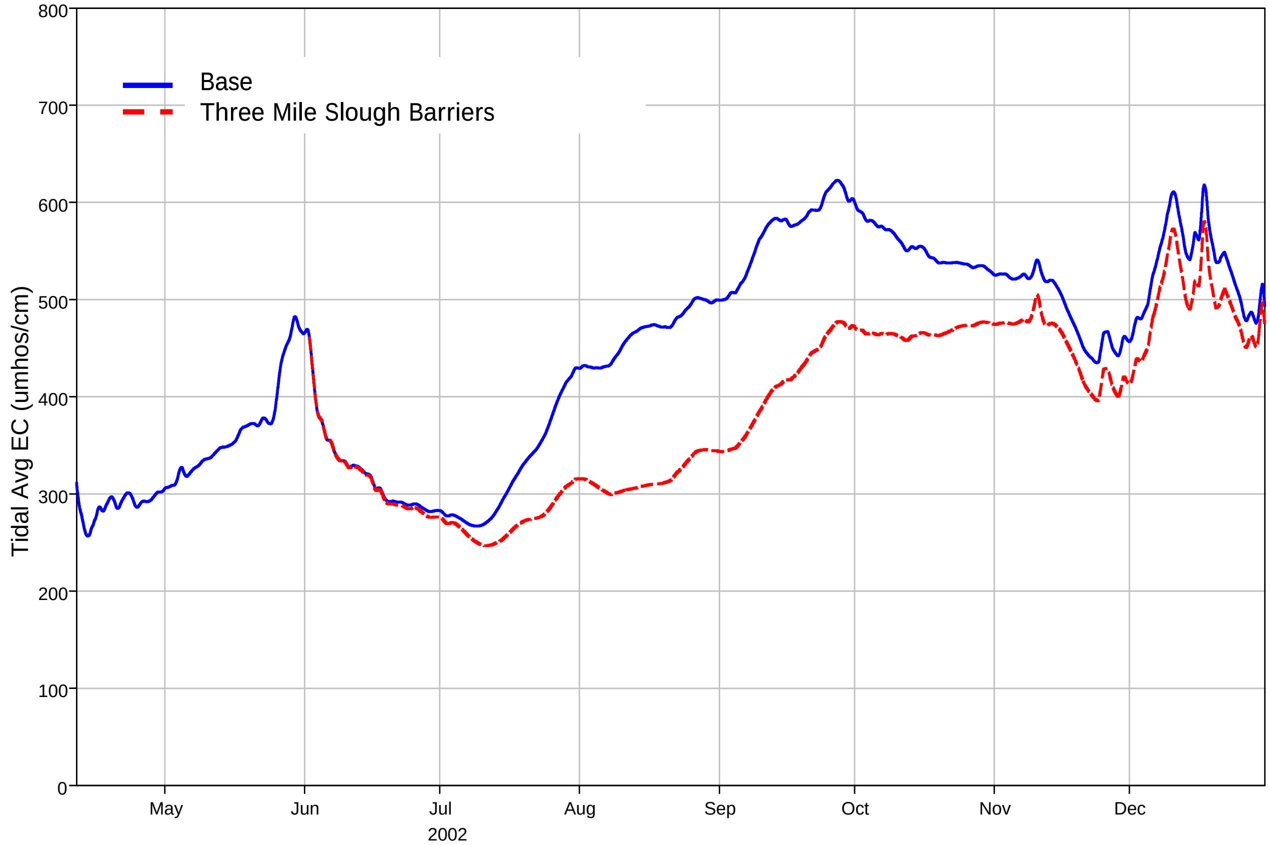

Figure 8. Tidally Average EC at SWP for Three Mile Slough Barrier Operation

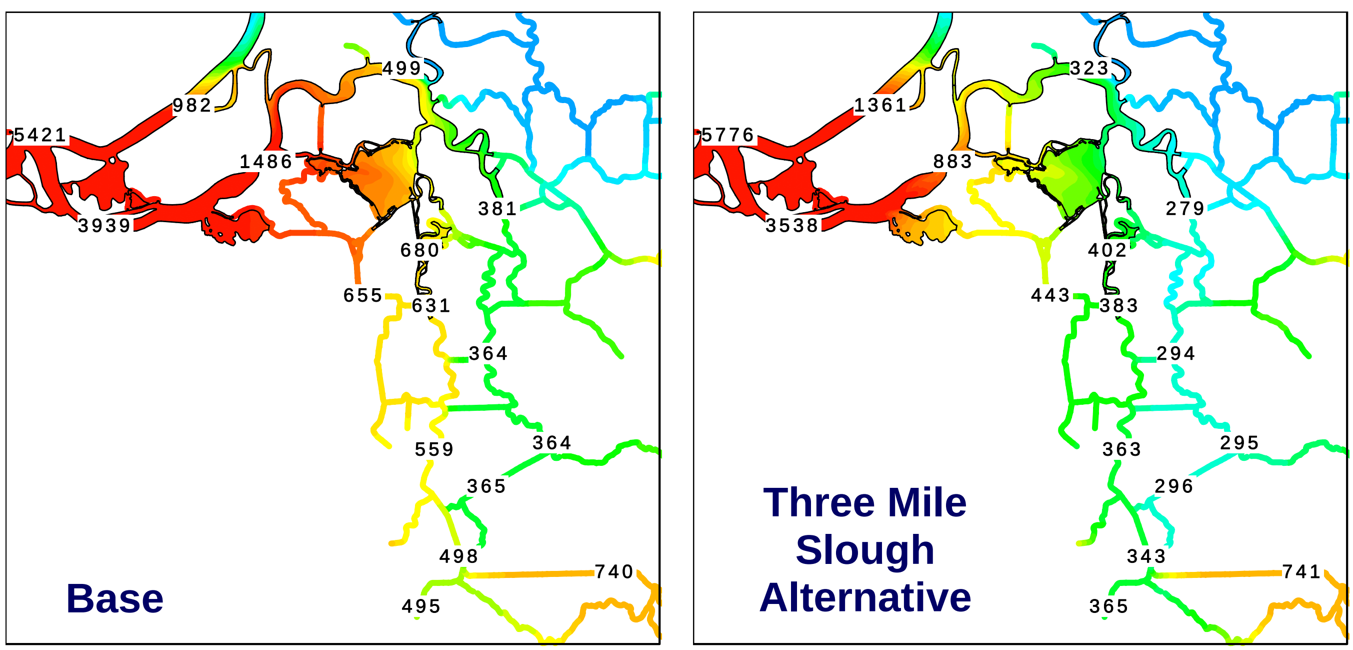

Figure 9. Tidally Average EC Contours on September 1, 2002 for Three Mile Slough Alternative

Figure 8 shows salinity reduction at the SWP due to the proposed operation of a Three Mile Slough barrier. The barrier operation provides higher salinity reduction during the months of salinity intrusion (July-November) compared to other months. Figure 9 shows a snapshot of EC contours on September 1st of 2002 in the central and south Delta for the base case and the Three Mile Slough alternative. The salinity is reduced in most of the central and south Delta including Old River, Middle River, and Victoria Canal. This should benefit Contra Costa Water District (CCWD), as they are considering a future intake at Middle River or Victoria Canal. The salinity at Emmaton is increased.

Three Mile Slough connects the two major water ways in the western Delta, namely the Sacramento River and the San Joaquin River. Peak tidal flow for the Sacramento River near Emmaton and the San Joaquin River near Jersey Point at times exceed 120,000 cfs, whereas, peak tidal flows at the Three Mile Slough are in the 30,000 cfs range. Although blocking ebb flow at Three Mile Slough for two to six hours each day has a noticeable effect on net flows in the area, the effects on the tidal flows and velocities in the Delta outside of the Three Mile Slough region are expected to be minimal. The Three Mile Slough alternative is designed to divert enough flow from the Sacramento River to the San Joaquin River in order to create a balanced net outflow towards the sea in both Sacramento and San Joaquin River. This in turn helps in reducing ocean salt intrusion into the Delta. The changes in hydrodynamics outside of the Three Mile Slough region are minimal.

<u>Comparison of Franks Tract Project Alternatives</u>

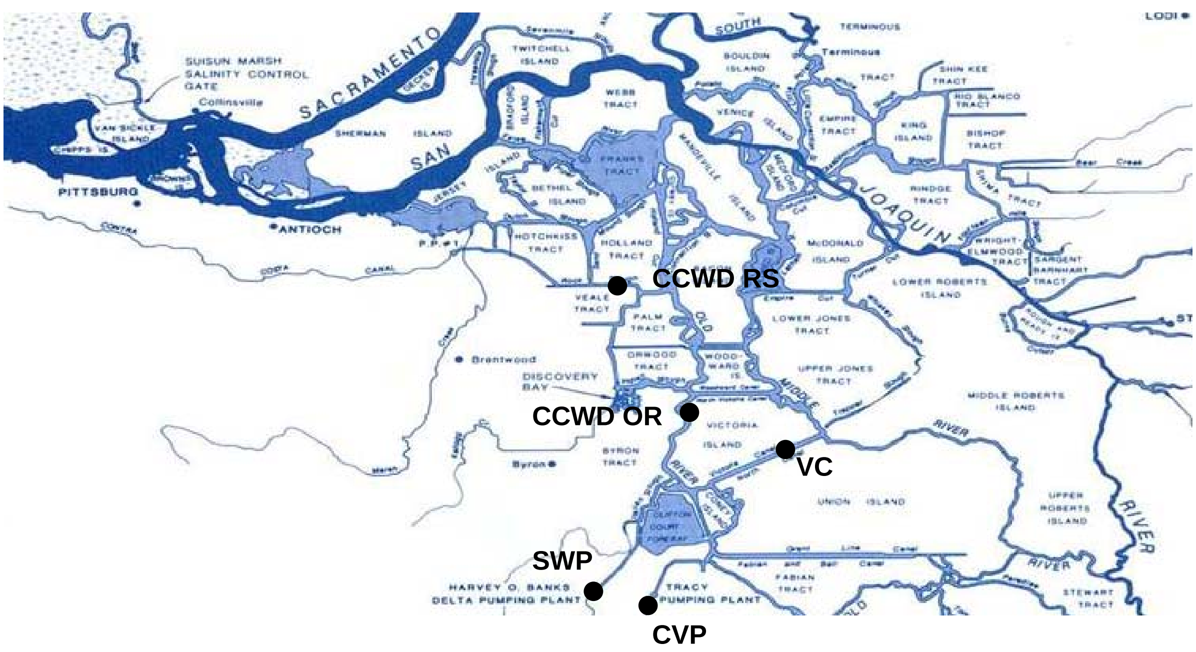

Figure 10. EC Output Locations

Figure 10 shows the five key locations: State Water Project (SWP), Central Valley Project (CVP), CCWD intake at Rock Slough, CCWD intake at Old River, and Victoria Canal, where EC results were evaluated and compared.

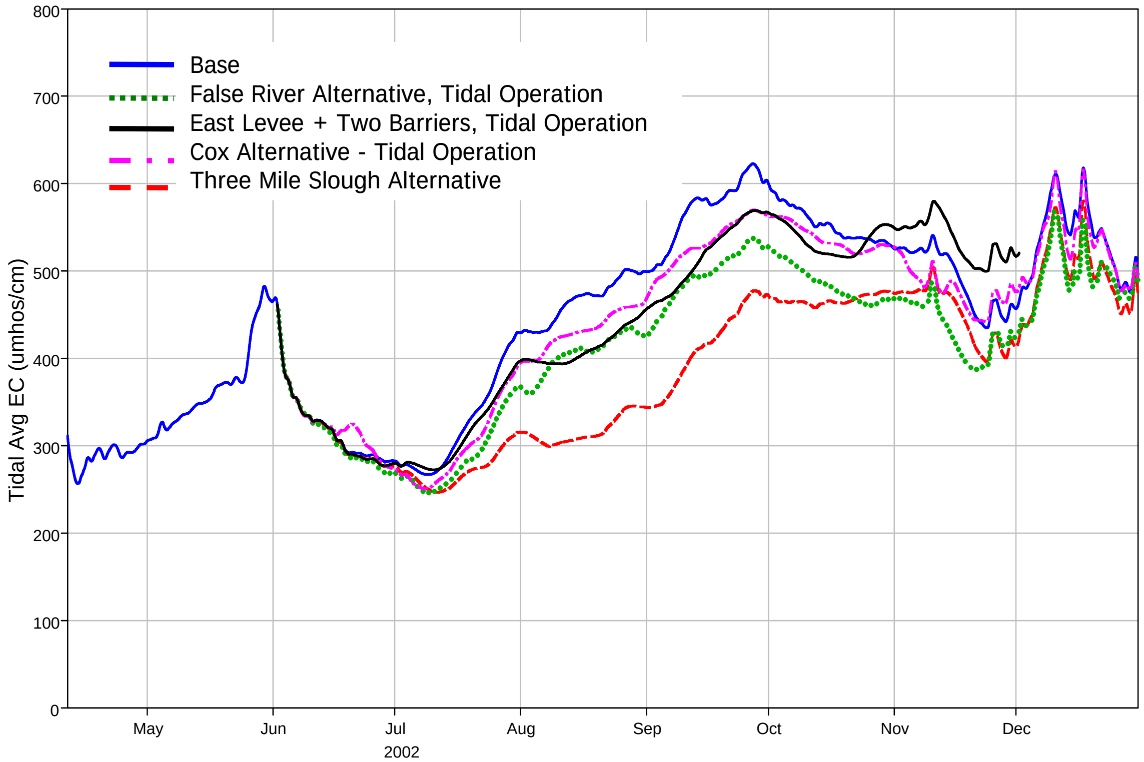

Figure 11. Comparison of Tidally Averaged EC at SWP

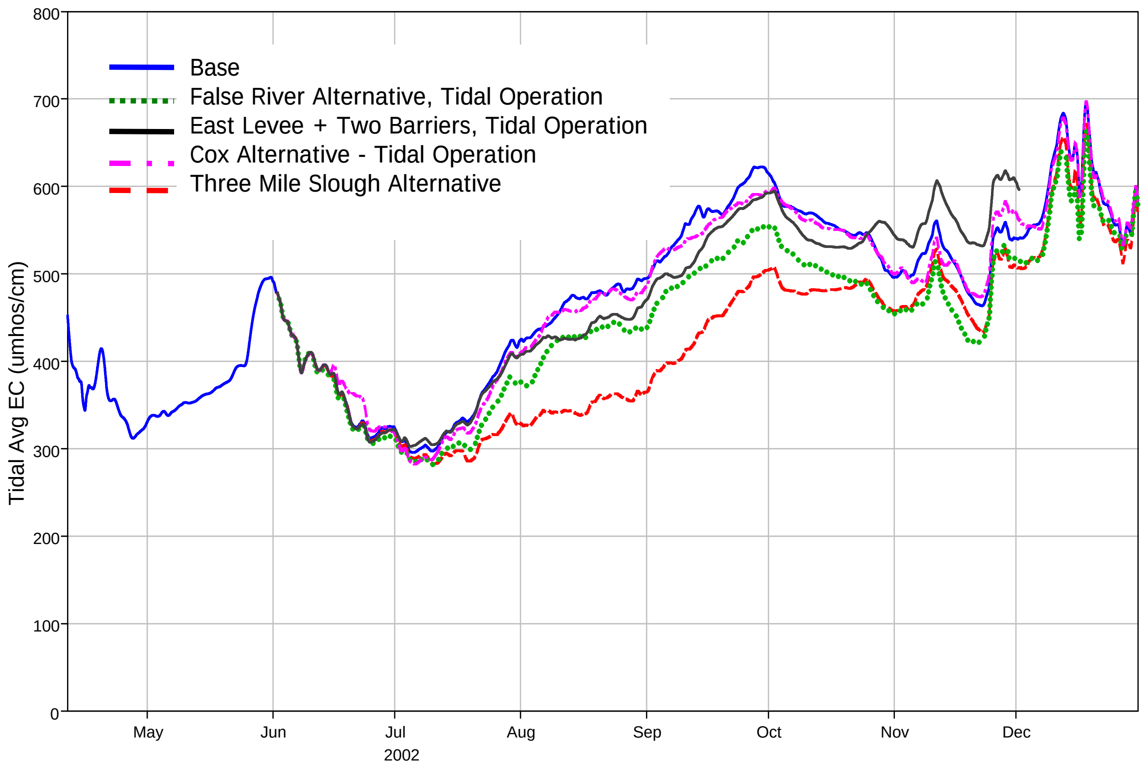

Figure 12. Comparison of Tidally Averaged EC at CVP

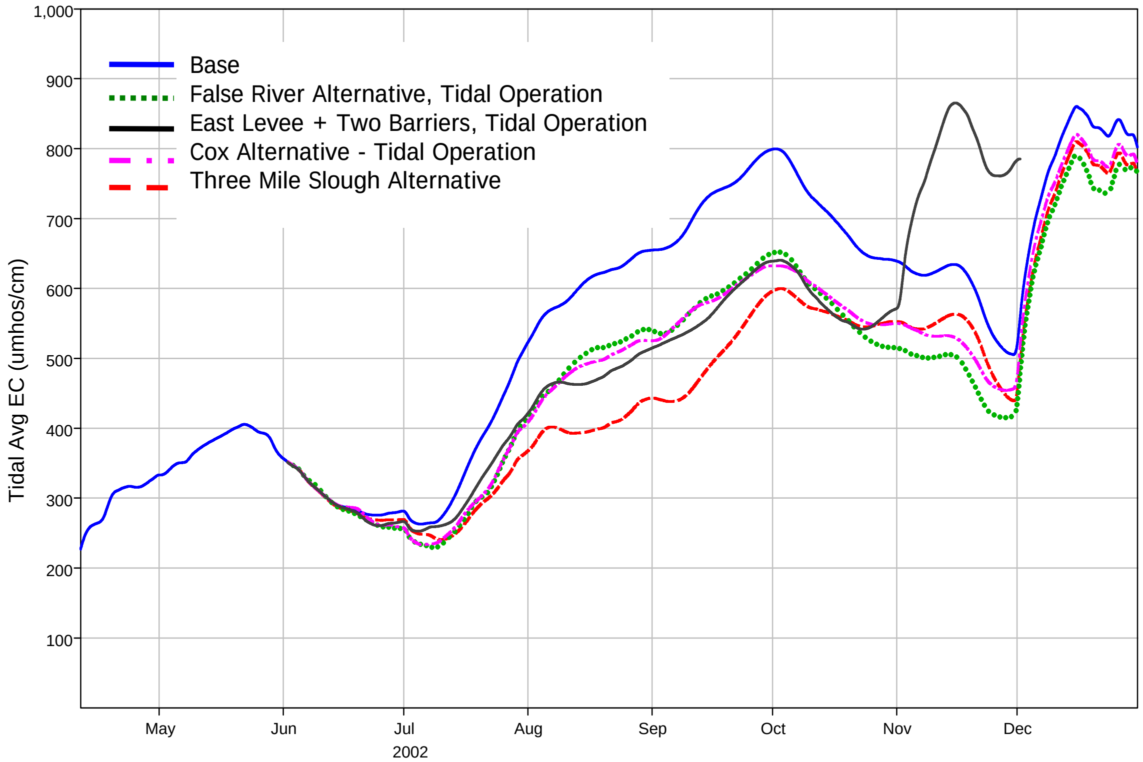

Figure 13. Comparison of Tidally Averaged EC at CCWD Rock Slough

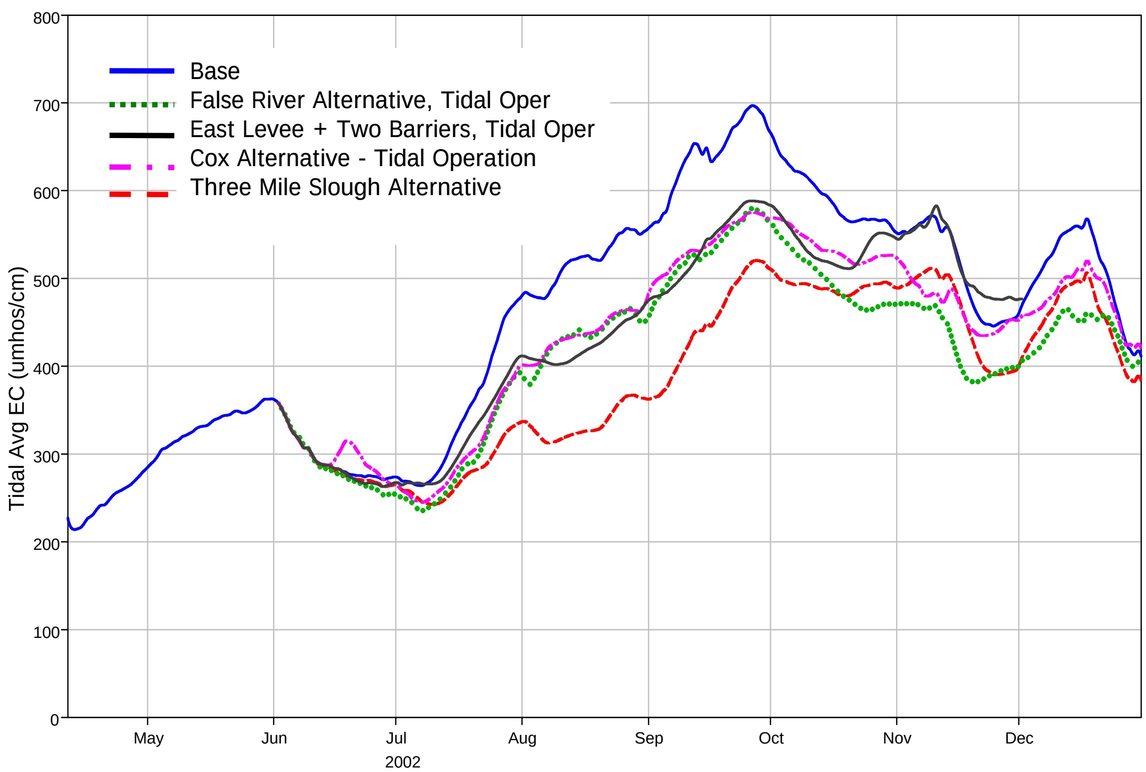

Figure 14. Comparison of Tidally Averaged EC at CCWD Old River

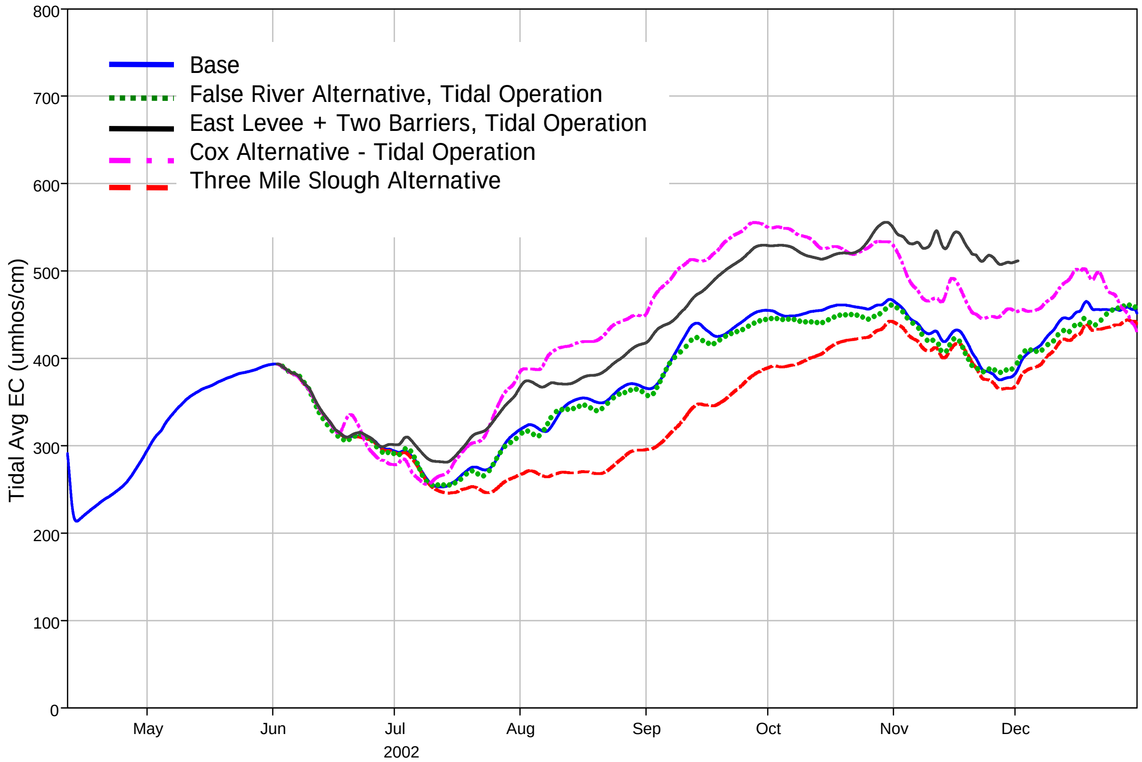

Figure 15. Comparison of Tidally Averaged EC at Victoria Canal

Figures 11 to 15 show the tidally averaged EC results at the five key locations for base and the four alternatives. One preferred barrier operation was selected from each of the four alternatives: (1) "tidally barrier operation" for The West False River alternative, (2) "barrier on east end of False River tidally operated (open on ebb) and barrier in Sand Mound Slough kept closed" for the East Levee + 2 Barriers alternative, (3) "Old River barrier tidally operated (open on ebb) and barrier in Holland Cut kept closed" for the Cox alternative, and (4) Three Mile Slough alternative operation. Following observations can be made from these figures:

- The Three Mile Slough alternative provides higher salinity reductions at all five key locations compared to the other three alternatives.
- Only the Three Mile Slough alternative reduces salinity in Victoria Canal (Figure 15). The West False River alternative does not alter salinity in Victoria Canal, while the remaining two alternatives increase salinity in Victoria Canal.
- The West False River alternative reduces salinity at SWP, CVP, CCWD intake at Rock Slough, and CCWD intake at Old River. This alternative performs slightly better than the Three Mile Slough alternative during the month of November.
- The West False River alternative performed better than the East Levee alternative and the Cox alternative.
- The East Levee alternative increases salinity at all five key locations during November.

Table 2. Comparison of Average EC Reduction for July 15 to November 30, 2002

Alternative	SWP	CVP	CCWD (Old River)	CCWD (Rock Slough)	Victoria Canal
2002 (Dry Year)					
West False River	12.7%	9.5%	16.6%	18.9%	1.6%
East Levee + 2 Barriers	4.0%	0.9%	10.9%	9.4%	-16.5%
Cox Alternative	5.2%	1.3%	12.7%	17.9%	-17.9%
Three Mile Slough	20.9%	16.7%	23.7%	24.3%	12.7%

Table 2 presents the average EC reductions of the four alternatives from July 15 to November 15, 2002 at the five key locations shown in Figure 10. Following are key observations:

- The Three Mile Slough alternative provides the highest salinity reduction at all five locations. The salinity reduction ranges from 13% to 24%.
- The West False River also provides salinity reduction at all locations. However, the salinity reduction in Victoria Canal is minimal.
- The remaining two alternatives provide about 4% to 5% salinity reduction at SWP intake, but that is minimal at the CVP. Both of these alternatives increase salinity in Victoria Canal.

As a result of the performance of the West False River alternative and the Three Mile Slough alternative in the preliminary analysis, these two alternatives were evaluated further for critical years 1992, 1994 and dry year 2001. The results, summarized in Table 3, indicate the West False River alternative performed better than Three Mile Slough alternative, except at the Victoria Canal.

Table 3. Comparison of Average EC Reduction for July 15 to November 30, 2002

Alternative	SWP	CVP	CCWD (Old River)	CCWD (Rock Slough)	Victoria Canal
1992 (Critical)					
West False River	16.2%	12.6%	21.0%	25.4%	10.5%
Three Mile Slough	Operational Criteria 2 and 3 are not met.				
1994 (Critical)					
West False River	13.4%	9.6%	17.8%	21.7%	2.2%
Three Mile Slough	8.1%	6.5%	9.7%	10.7%	4.4%
2001 (Dry Year)					
West False River	13.7%	10.9%	18.3%	20.1%	1.9%
Three Mile Slough	12.3%	10.3%	14.3%	14.9%	6.8%

Additional Potential Benefits of Three Mile Slough Alternative

There are two additional potential benefits that the Three Mile Slough alternative may provide. The first potential benefit is that the Three Mile Slough barrier can be operated to reduce the impact due to small to medium levee failures in the interior or south delta islands. This can be achieved by completely blocking flow from San Joaquin River to Sacramento River. This action results in reduction of the amount of sea water intrusion. For example, during Jones Tract failure in June 2004, it is estimated that water flowed into Jones Tract at a rate of about 20,000 to 25,000 cfs during the first 3 days. Model results have shown that such an event could temporarily create a huge reverse flow in San Joaquin River causing major salt intrusion. Three Mile Slough barrier if completely closed during all ebb tides increases the net flow in San Joaquin River by about 8,000 to 10,000 cfs, thus reducing sea water intrusion.

The second potential benefit of the Three Mile Slough barrier is that it can offer water quality benefits similar to Delta Cross Channel (DCC) gates. The DCC gates at times have to be closed to prevent fish in the Sacramento River from moving toward the Central Delta and eventually towards the export facilities. However, the closure of DCC results in less Sacramento River water entering the central Delta and can lead to increased salinity intrusion from the ocean. One such event occurred in December 1999, when the DCC was closed to protect fish. During such an event, the Three Mile Slough barrier could have been operated to reduce the salinity in the Delta while keeping the DCC closed to protect fish. The real scenario was not simulated in this study. The potential benefit of Three Mile Slough barrier was illustrated using a hypothetical scenario of closing the DCC during 2002 and using a Three Mile Slough barrier to alleviate the salinity intrusion caused by the DCC closure. The DCC gate operation schedule used in base case is shown in Figure 16; both DCC gates were open during middle of June in 2002 through November, except during last two weeks of October and first two weeks of November only one of gates in DCC was kept open.

Figure 17 shows the salinity at the SWP for three scenarios: (1) the base case - DCC gates are operated as shown in Figure 16, (2) DCC gates closed - DCC gates are completely closed, and (3) Three Mile Slough in lieu of DCC - DCC gates are completely closed for the entire period and the Three Mile Slough alternative was operated in lieu of the DCC. The Three Mile Slough alternative alleviated the salinity increased by the closure of DCC. Figure 18 shows the additional net flows in the Three Mile Slough that was diverted from Sacramento River to San Joaquin River during this period.

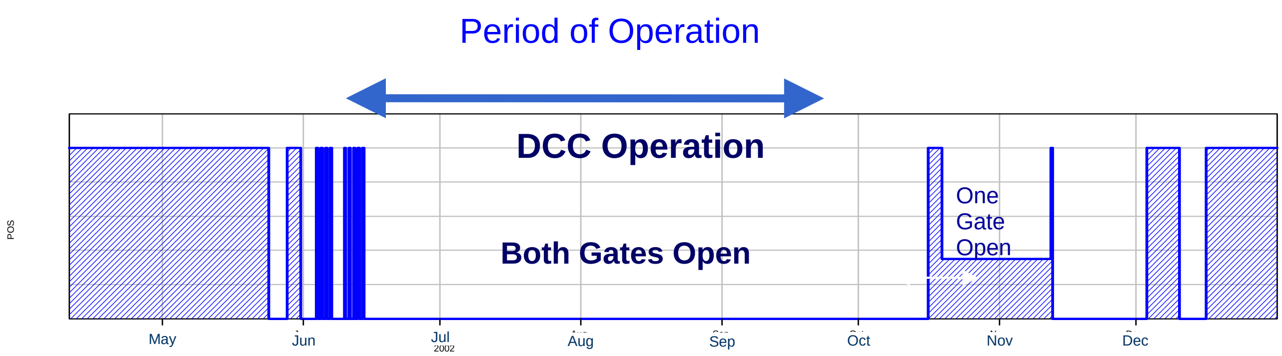

Figure 16. Delta Cross Channel Gate Operation Schedule for Year 2002

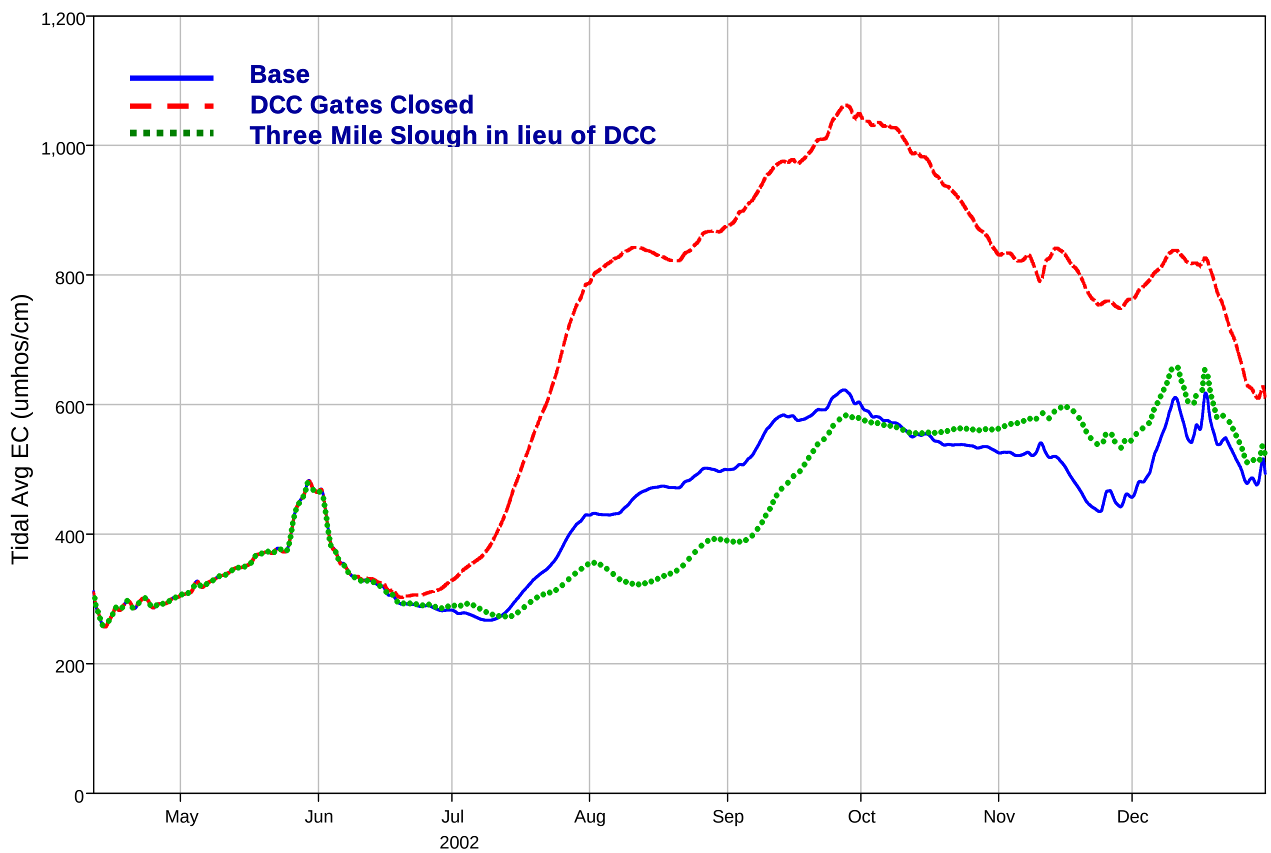

Figure 17. Salinity Benefit at SWP from Three Mile Slough Barrier Operation in-lieu of Delta Cross Channel

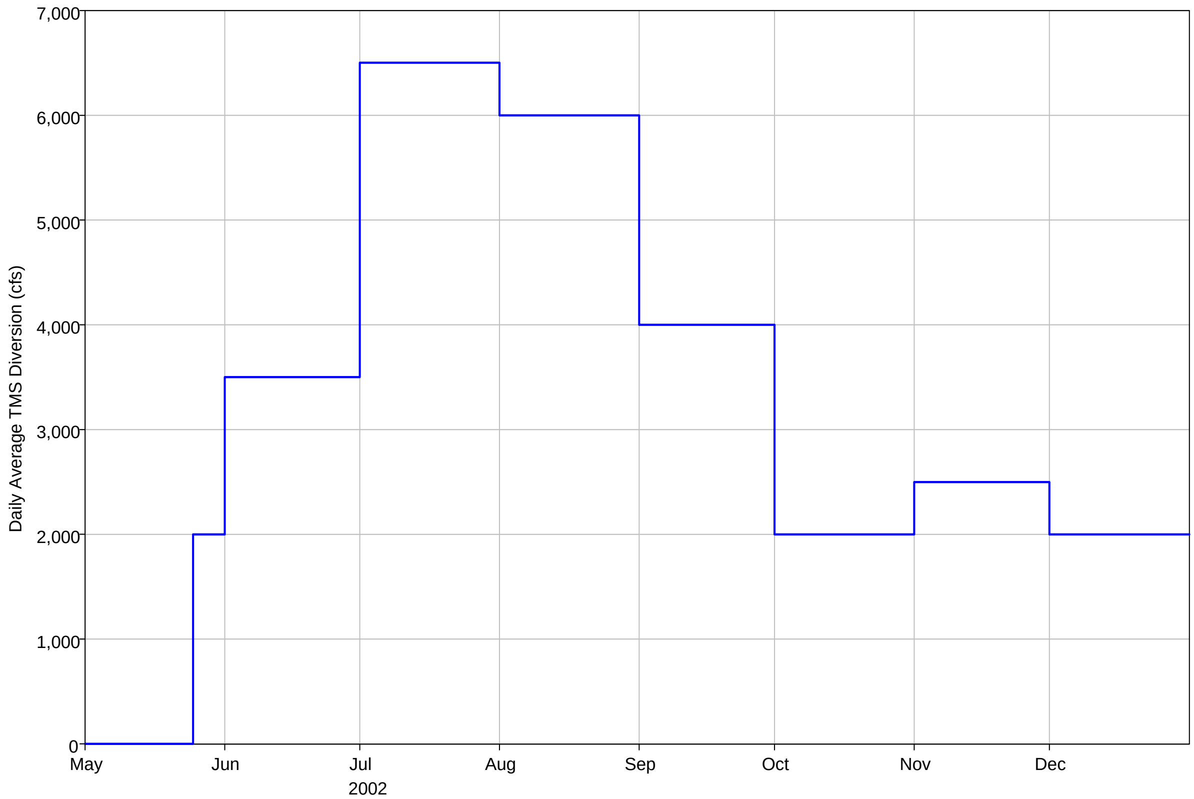

Figure 18. Additional Net Flows Diverted through Three Mile Slough When Operated in-lieu of Delta Cross Channel

<u>Long Term Water Quality Modeling Results for West False and Three Mile Slough Alternatives</u>

A long term (16 years) modeling and analysis of salinity reduction at key locations in the south Delta for the Three Mile Slough and the West False River alternatives are provided in Shrestha (October, 2007). The long term results show that both alternatives provide salinity reduction at the key export locations. At the SWP, the Three Mile Slough alternative provides 10% to 12% salinity reduction, and the West False River alternative provides 5% to 7% salinity reduction. The Three Mile Slough alternative provides higher salinity reductions during wet, dry and critical years and the West False River provides higher salinity reductions during critical years.

Conclusions

Following are the conclusions made from the limited short-term hydrodynamic and water modeling studies:

1. All four alternatives: the West False River Barrier, the East Levee plus 2 Barriers, the Cox alternative and the Three Mile Slough Barrier, provide salinity reductions due to sea water intrusion at key locations in the south Delta: SWP, CVP, CCWD intake at Rock Slough, CCWD intake at Old River (Figure 10). The West False River Alternative and the Three Mile Slough alternative also provide salinity reduction in Victoria Canal, while the remaining two alternatives increased salinity in Victoria Canal.

2. The fully-closed barrier operations for (1) the West False River Alternative, (2) the East Levee plus 2 Barriers alternative, and (3) the Cox alternative provide the higher salinity reduction at the export locations than that the operational scenario when the barriers are tidally operated. However, the complete closure of the barrier has impacts on boating. Therefore these operations are not desirable.

3. The 20% barrier width open operational scenario of the West False River alternative results in higher velocities in the vicinity of the barriers. Therefore this operation scenario for the West False River has a safety issue for boat users.

4. Modeling results indicate that the Three Mile Slough alternative and the West False River alternative provide higher salinity reductions at the key locations (Figure 10) compared to the other two alternatives. These are also the only two alternatives which do not increase salinity at Victoria Canal.

5. The West False River alternative provides higher salinity reductions during the critical years. During the dry years, both the Three Mile Slough alternative and West False River alternative outperform (in salinity reduction) the other two remaining alternatives.

6. The Three Mile Slough alternative may also be used in lieu of DCC gates. The Three Mile Slough alternative may provide help in reducing salinity during small to medium levee failures in the central and south Delta.

7. Closure of the barrier in the West False River physically blocks sea water intrusion to Franks Tract region, thereby creating a longer path for sea water to reach export facilities in the south Delta (via Old River). This in turn reduces the salinity at the Old River and the SWP and CVP export facilities. This alternative however does not alter salt path in the Middle River and Victoria Canal. Therefore the salinity reduction in both the Middle River and the Victoria Canal are minimal.

8. The East Levee + 2 Barriers alternative and the Cox alternative allow salt mixing at Franks Tract but block salt water intrusion to the export facilities via Old River. The sea water travels to the export location via Middle River and the Victoria Canal. Therefore, the salinity increases in Victoria Canal for these alternatives.

9. The Three Mile Slough barrier is operated on the tidal basis, closing a few hours during ebb tides. The barrier operations increase the net outward flows in the San Joaquin River (near Jersey Point). This increase in net outward flows helps in reducing the sea water intrusion to the central and south Delta. The Three Mile Slough barrier operation is not required during the times when 1) there is no sea water intrusion in central and south Delta; 2) the net outward flows at Emmaton and Jersey Point were balanced; and 3) the combined net flows at Emmaton and Jersey Point were small.

10. Closure of the Three Mile Slough barrier during ebb tide increases the net outward flows in San Joaquin River near Jersey Point. This increase in net outward flows reduces the salinity intrusion from the sea in the central and south Delta, effectively reducing salinity throughout the central and portions of south Delta region. This alternative provides salinity reductions at both the Middle River and Victoria Canal.

References

Department of Water Resources (2005) - “Flooded Islands Pre-Feasibility Study Report”, prepared by EDAW Inc. for California Department of Water Resources, Sacramento, California. http://baydeltaoffice.water.ca.gov/ndelta/frankstract/

Department of Water Resources (2007) - “Value Engineering Study – Franks Tract Pilot Project Report” prepared by Strategic Value Solutions Inc. for California Department of Water Resources, Sacramento, California. http://baydeltaoffice.water.ca.gov/ndelta/frankstract/

Resources Management Associates, RMA (2005) - “Flooded Islands Pre-Feasibility Study, Alternatives Modeling Report”, prepared for California Department of Water Resources, Sacramento, California. http://baydeltaoffice.water.ca.gov/ndelta/frankstract/

Shrestha, B. to Pacheco, V. and Goyal (2007) - An Interoffice memorandum regarding “Long Term Water Quality Modeling for Franks Tract Project”, Delta Conveyance Branch, Bay-Delta Office, California Department of Water Resources, Sacramento, California. http://baydeltaoffice.water.ca.gov/ndelta/frankstract/